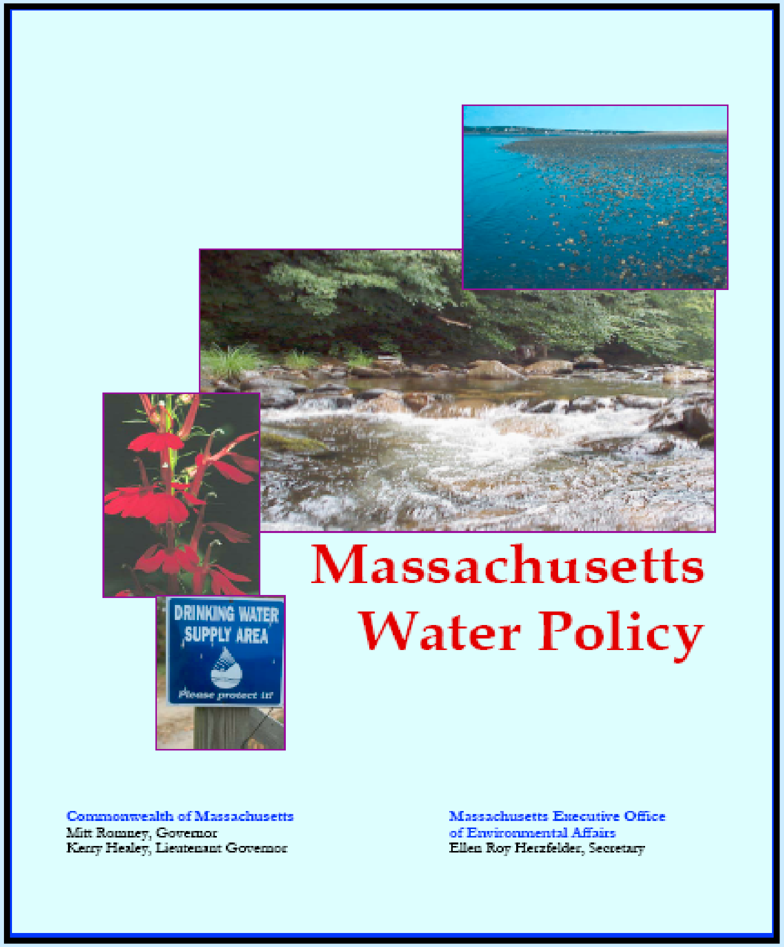
Economics of Water Conservation and Alternatives

Kathleen Baskin, P.E.
Director of Water Policy
MA Executive Office of Environmental Affairs

October 20, 2006

MA Water Policy - 2004

- Emphasize efficient water use in all sectors, including:
  - Water conservation
  - Stormwater recharge
  - Water reuse
- EOEA agencies engaged in implementation



Cost Savings as a Result of Water Conservation

Reduced operation and maintenance (energy and chemicals)

- Water – pumping, treatment and distribution
- Wastewater – collection, treatment and disposal

Delayed, downsized, or eliminated capital facilities

- Water treatment
- Water storage
- Wastewater treatment
- On-site sewage disposal systems (avoids hydraulic overload)

Reduced water purchases from wholesale water providers (i.e. MWRA, Aquaria)

Sources: AWWA Manual M52 and www.epa.gov/ow/you/chap2.html

Estimated impact of national efficiency standards on water consumption

Cites: Study of 16 utilities serving 11 million people (AWWA)

Conclusions:

- Reduction in water consumption by 3 to 9 percent and
- Savings of $166 M to $231 M in deferred or avoided water supply infrastructure investments by 2020

Source: GAO/RCED-00-232 and Vickers, 2001

[GAO’s report was prepared at request of Congress in response to 1999 Legislation to Repeal Energy Policy of 1992. The U.S. Energy Policy Act of 1992 established water use limits on toilets (1.6 gal per flush), urinals (1.0 gal per flush), showers (2.5 gal per min) and faucets (2.5 gal per minute). The Act was not repealed.]

Estimated impact of national efficiency standards on wastewater flow

Cites

- AWWA: Study of four locations (Austin, Los Angeles, Phoenix, Tampa): Standards will reduce wastewater flows between 5 and 8% and cost savings of about $180M by 2020
- EPA: 25% reduction estimated nationwide (likely overestimated; does not estimate conservation in absence of standards)

Conclusions

- Reductions in wastewater flows can also lead to “significant savings”
- Wastewater flows to publicly owned treatment works (POTWs) could be reduced by 13% by 2016 (adjusts EPA study)

Source: GAO/RCED-00-232

Estimated impact on building industry

Conclusions

- Building moratoria rarely imposed
- Only 7 of 16 states studied used moratoria, usually by only 1 or 2 communities within a state.

Source: GAO/RCED-00-232

Example: Boston Water and Sewer Commission

Daily demand (mgd)

	w/o standards	w/standards	amount of saving	% savings
2010	84.2	81	3.2	3.8
2020	85.1	79.4	5.7	6.7

Investment in water supply infrastructure through 2020
($ discounted at 3%)

	w/o standards	w/standards	amount of saving	% savings
2020	$820.70	$788.60	$32.10	3.9

(dollars in millions)

Source: GAO/RCED-00-232

GAO Conclusion

"Repealing the national water efficiency standards could exacerbate the financial pressures facing local communities by forcing them to build or expand treatment and storage facilities sooner than planned."

Source: GAO/RCED-00-232

Capital Costs of new water and wastewater treatment facilities (2006 estimate)

Water

- $2/gpd of capacity (adding to existing plant) typical nationwide
- $4/gpd of capacity in Austin, TX
- ~ $10/gpd of capacity in Reading, MA (anecdotal info from town)
- $5/gpd of capacity = MWRA entrance fee

Wastewater treatment

- $3/gpd typical nationwide

Source: AWWA Manual M52 and Reading personal communication

Case Study in Austin, Texas

Program focused on peak demands

- Irrigation audits
- Rebates (irrigation systems, low flow toilets)
- Public awareness
- Amendments to landscape code (xeriscaping, efficient irrigation)

Results

- Deferred expansion of 2 wastewater treatment plants
  (10% reduction would defer one plant for 5 years and another for 8 years)
- Benefit = $2.18 per 1000 gallons saved (72% capital deferral, 28% O&M)
- Energy conservation – see handout (58% of all electricity by municipality is for water and wastewater pumping)

Source: William O. Maddaus and AWWA Manual M52

EPA Case Studies
Cost and Savings

Ashland, OR

- $7M-$11M in water supply development avoided
- Program cost = $825,875

Houston, TX, 60 unit apartment

- Replaced toilets (1.6 gal/flush), fixed leaks, installed aerators
- Reduced consumption by 73%
- Reduced cost to $1,810/mon (savings of $6,834/mon)
- Ave annual water bill reduced from $1,700 to $360
- Program cost = $22,000

Source: EPA, Cases in Conservation

EPA Case Studies
Rates

Irvine Ranch Water District, CA

Water Rates Program	Cost per 1,000 gallons
Low volume discount	$0.64
Conservation base rate	$0.85
Inefficient	$1.71
Excessive	$3.42
Wasteful	$6.85

Conclusions:

- Water use declined 19% within first year of implementation (1991-1992)
- Customer satisfaction with rate structure had 85 to 95% approval

Source: EPA, Cases in Conservation

Stormwater Recharge

	cost/1,000 gal (1997 $)
Retention/detention basin	0.67 - 1.34
Constructed wetland	0.80 - 1.67
Infiltration trench	5.30
Infiltration basin	1.70
Sand filter	4.0 - 8.0
Bioretention	7.10
Grass swale	0.67
Filter strip	$\leq$1.70
Range	0.67 - 8.0

Source: EPA, 1999

Infiltration/Inflow Removal and Wastewater Recharge

- I/I remediation capital costs range from $4 to $8 per gallon per day (can be higher or lower)[1]

  (Plymouth = $16 per gpd; Weymouth = $10 per gpd; Canton = $4 per gpd)

- Wastewater recharge[2]
  - ~ $25 per gpd
  - $0.03 – $0.08 per gpd over 20 project life (at 5%)

Sources:

[1]Personal communication with DEP, MWRA, LNR and communities of Plymouth, Weymouth

[2]SEA, 2002

Costs and Savings of Conservation and Alternatives

Conservation[1]

- $0.00005 - $0.0008/gpd saved (Cary, NC)
- Minimal to $0.002/gpd saved (Sharon, MA)

Avoided O&M costs1[1]

- Electricity ~ $0.10/gpd
- Chemicals ~$0.033 - $0.043/gpd

Avoided Capital Costs

- Water treatment ~ $2/gpd - $10/gpd[2]
- Wastewater treatment ~ $3/gpd[2]
- Additional supplies
  - Well development ~ ≤7.45/gpd ($745,000 for 100,000gpd or greater, see LeVangie presentation)
  - MWRA
    - Entrance fee = $5/gpd[3]
    - Wholesale cost ~$0.0022/gpd[3]
  - Desalination
    - Wholesale cost ~ $0.0034/gpd (Swansea)[4] to $0.0062/gpd (Weymouth NAS connection to Aquaria)[5]

Indirect Alternatives

- Stormwater recharge ~ $1- $8/gallon treated[6]
- Wastewater recharge ~ $25/gallon treated[7]
- I/I removal ~ $4 to $8/gal removed[8]

Costs and Savings of Conservation and Alternatives

Sources for previous slide:

[1]EPA Cases in Conservation

[2]AWWA Manual M52 and Reading personal communication

[3]MWRA personal communication

[4]Epsilon, 2005

[5]LNR personal communication (Rich Kleinman)

[6]EPA, 1999

[7]SEA, 2002

[8]Personal communication MWRA, DEP and LNR

$1 Billion/Year Industry (2001 study)

	Fishing*	Hunting**	Wildlife Watching
Participants	615,000	66,000	1,686,000
Days/Year	7,685,000	1,158,000	NA
Total Expenditures	$465 million	$59 million	$469 million
Expenditure/Participant	$756	$894	$278 .

*Approximately 2/3 = freshwater fishing
**Includes water fowl

Factoids:
Ecosystem services of freshwater wetlands = ~$15,000/acre/year.
"Outdoor activity" is 3rd most popular tourist activity in MA.

Sources: US FWS, 2001; MA Office of Travel and Tourism; MA Audubon Society, 2003.

Values of Recreation

On-water activities	(Cost per day in 1997 $)
Boating	$12 - $35
Swimming	$19 - $24
Fishing	$16 - $29

Streamside activities	
Cross-country skiing	$15 - $16
Walking, hiking	$12 - $30
Running	$3
Biking	$17
Picnicking	$16 - $26
Wildlife Viewing	$12 - $28

Sources: Bergstrom and Cordell, 1991; Walsh et al, 1992.

Conclusions

"The short-term savings from efficiency measures that reduce production costs (energy, chemical and treatment costs) help to offset revenue decreases.

Periodic rate adjustments can recover the inflation in utility costs in additional to recovering any less revenue, thus the actual economic impact is insignificant.

The primary concern of utility decision makers over reduced revenue can frequently be avoided by incorporating estimated conservation program savings into future demand forecasts and rates prior to program implementation."

Source: AWWA Manual M52

Conclusions

Over the long-term, considerable savings ($, water, air emissions) can be achieved through conservation

Reports Cited

American Sportfishing Association (undated). Sportfishing in America: Values of Our Traditional Pastime. http://www.asafishing.org/asa/images/statistics/participation/sportfishing_america/fish_eco_impact.pdf

American Water Works Association, 2006. Water Conservation Programs – A Planning Manual. Manual of Water Supply Practices M52.

Bergstrom, John C. and H. Ken Cordell. 1991. An Analysis of the Demand for and Value of Outdoors Recreation in the United States. Journal of Leisure Research, Vol. 23, No. 1. (As reported in An Assessment of Stormwater Control in the Charles River. Prepared for MA DEP. Watershed 104(b)(3) Project No. 97-04/104 (1997-2000), prepared by Charles River Watershed Association, 2000.)

Epsilon, 2006. Supplemental Final Environmental Impact Report Swansea Desalination Project, EOEA # 13183.

Maddaus, William O. Realizing the Benefits from Water Conservation. http://www.ucowr.siu.edu/updates/pdf/V114_A2.pdf.

Massachusetts Audubon Society, 2003. Losing Ground: At What Cost? http://www.massaudubon.org/news/index.php?id=19&type=news

SEA Associates, 2002. Town of Bellingham, Comprehensive Water Resources Management Plan/Environmental Impact Report. EOEA # 11602.

Reports Cited

U. S. Environmental Protection Agency (undated). Cases in Conservation: How Efficiency Programs Help Water Utilities Save Water and Avoid Costs. http://www.epa.gov/watersense/docs/utilityconservation_508.pdf

U. S. Environmental Protection Agency (website). Cleaner Water through Conservation. http://www.epa.gov/ow/you/chap2.html

U. S. Environmental Protection Agency, 1999. Preliminary Data Summary of Urban Storm Water Best Management Practices. http://www.epa.gov/waterscience/stormwater/

U.S. General Accounting Office, 2000. Water Infrastructure: Water-Efficient Plumbing Fixtures Reduce Water Consumption and Wastewater Flows. GAO/RCED-00-232. http://www.gao.gov/new.items/rc00232.pdf.

U.S. Department of Interior, Fish and Wildlife Service and U.S Department of Commerce, U.S. Census Bureau. 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. http://www.census.gov/prod/2003pubs/01fhw/fhw01-ma.pdf.

Vickers, Amy, 2001. Handbook of Water Use and Conservation: Homes, Landscapes, Businesses, Industries, Farms. Published by WaterPlow Press, Amherst, MA.

Walsh, Richard G., Donn M. Johnson and John R. McKean, 1992. Benefit Transfer of Outdoor Recreation Demand Studies, 1968-1988. Water Resources Research, Vol. 28, No. 3, Pages 707-713.